

15

The invention claimed is:

1. A method of fabricating a GaN-based semiconductor device substrate, comprising:

implanting a Si substrate with an ion species capable upon annealing of forming bubbles;

after the implantation, cleaning the Si surface using conditions that do not cause dissipation of the implanted ions or bubbles formed therefrom to the Si substrate surface;

growing a GaN/Si buffer layer on the cleaned Si substrate with a thermal treatment so that a buffer/Si interface is formed, and whereby annealing of the Si substrate is also effected so that bubbles of the implanted ion species are formed in the Si at an appropriate distance from the buffer/Si interface so that the bubbles will not migrate to the Si surface during annealing, but are close enough to the interface so that a strain field around the bubbles will be sensed by dislocations at the buffer/Si interface such that the dislocations are attracted by the strain field caused by the bubbles and move into the Si substrate instead of into the buffer layer; and

16

growing a layer of GaN, or other III-Nitride based on GaN, such as InGaN or AlGaN, on the buffer layer.

2. The method of claim 1, wherein The method of claim 1, wherein the ionic species is selected from the group consisting of He, N and H.

3. The method of claim 1, wherein the ionic species is He.

4. The method of claim 3, wherein the GaN/Si buffer layer is an AlN layer.

5. The method of claim 4, wherein the implant and anneal is conducted such that the He bubbles form about 100-250 nm from the AlN/Si interface.

6. The method of claim 2, wherein the Si surface clean is conducted at a temperature below 300° C.

7. The method of claim 6, wherein the Si surface clean is a wet chemical clean conducted at a temperature of about 80° C.

8. The method of claim 7, wherein the Si surface clean is without a thermal anneal following the wet chemical clean and before growing the buffer layer.

* * * * *